Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)	
	)	
Connect America Fund	)	WC Docket No. 10-90
	)	
ETC Annual Reports and Certifications	)	WC Docket No. 14-58
	)	
Rural Broadband Experiments	)	WC Docket No. 14-259
	)	

COMMENTS OF THE FIBER TO THE HOME COUNCIL AMERICAS ON THE FURTHER NOTICE OF PROPOSED RULEMAKING

The Fiber to the Home Council Americas ("FTTH Council" or "Council")[1] hereby submits comments in response to the Federal Communications Commission's ("Commission's") Further Notice of Proposed Rulemaking in the above-referenced proceedings regarding the development of rules to implement a competitive bidding process for Phase II of the Connect America Fund ("CAF").[2] In particular, the FTTH Council responds to the Commission's request for comment on the proposal to "establish weights for specific types of bids that represent the relative benefits of services that provides higher speeds, higher usage allowances, and/or lower

[1] The FTTH Council's mission is to accelerate deployment of all-fiber access networks by demonstrating how fiber-enabled applications and solutions create value for service providers and their customers, promote economic development, and enhance quality of life. The FTTH Council's members represent all areas of the broadband access industry, including telecommunications, computing, networking, system integration, engineering, and content-provider companies, as well as traditional service providers, utilities, and municipalities. As of today, the FTTH Council has more than 300 entities as members. A complete list of FTTH Council members can be found on the organization's website: http://www.ftthcouncil.org.

[2] *Connect America Fund et al.*, WC Docket No. 10-90 et al., Report and Order and Further Notice of Proposed Rulemaking, FCC 16-64 (rel. May 26, 2016) ("FNPRM").

latency over service that meets lower requirements for participation in the Phase II auction."[3] As discussed herein, the FTTH Council submits that to meet the need of consumers in unserved areas and fulfill its statutory mandate, the Commission's bid weighting mechanism should be based primarily on consumers' broadband preferences and needs expected over the life of the program.

The purpose of the CAF program is to "ensure that robust, affordable voice and broadband service, both fixed and mobile, are available to Americans throughout the nation."[4] The program was established to carry out the mandate in Section 254 of the Communications Act that consumers residing in rural areas of the nation "have access to telecommunications and information services … that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."[5] The FTTH Council shares the Commission's objective to bring high-quality broadband service to as many unserved areas as quickly as possible, and has advised the Commission on a number of issues related to its achievement, including advocating for the adoption of rules and policies that would facilitate the deployment fiber-based services.[6]

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3 *Id*., ¶ 211.

4 *Connect America Fund et al.*, WC Docket No. 10-90 et al., Report and Order and Further Notice of Proposed Rulemaking, 26 FCC Rcd 17663 (2011) ("USF/ICC Transformation Order").

5 47 U.S.C. § 254(b)(3).

6 *See Ex Parte* Letter from Edward A. Yorkgitis, Jr., Counsel for the FTTH Council, to Marlene H. Dortch, Secretary, FCC, WC Docket No. 10-90 (Nov. 20, 2015) ("FTTH Council November 2015 Ex Parte"); *See Ex Parte* Letter from Thomas Cohen, Counsel for the FTTH Council, to Marlene H. Dortch, Secretary, FCC, WC Docket No. 10-90 (Jan. 21, 2016) ("FTTH Council January 2016 Ex Parte"). The benefits of fiber are numerous: fiber is the most superior technology with which to provide high-performance broadband service; fiber is the choice of consumers and businesses in urban areas; fiber confers tremendous economic benefits on communities and individuals; and fiber would

In the FNPRM, the Commission adopted a technology-neutral framework for CAF Phase II, specifically establishing four tiers of services available for bidding with varying speed and usage allowances.[7] The FNPRM further establishes that for each of the four tiers, bidders will designate their services as either high latency or low latency, and all bids will be considered simultaneously, regardless of performance tier.[8] According to the Commission, the framework set forth in the FNPRM "strikes a balance by providing sufficient granularity with respect to the performance characteristics of broadband offerings, while maintaining an auction design that will encourage a broad range of providers to participate in the auction."[9] The FTTH Council submits that although the four-tiered technology-neutral framework would not be the Council's preferred approach for the CAF Phase II program, it demonstrates that the Commission recognizes that greater levels of broadband performance can produce greater benefits for consumers. The

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provide the Commission with a superior, or at least equivalent, return on its CAF investment when compared to other wireline technologies.

7 FNPRM, ¶ 2. The four tiers are as follows:

Minimum Performance – bidders must commit to provide broadband speeds of at least 10 Mbps downstream and 1 Mbps upstream (10/1 Mbps) and offer at least 150 gigabytes (GB) of monthly usage.

Baseline Performance – bidders must commit to provide at least 25 Mbps downstream and 3 Mbps upstream (25/3 Mbps) and offer a minimum usage allowance of 150 GB per month, or that reflects the average usage of a majority of fixed broadband customers, using Measuring Broadband America data or a similar data source, whichever is higher.

Above-Baseline Performance – bidders must commit to provide at least 100 Mbps downstream and 20 Mbps upstream (100/20 Mbps) and offer an unlimited monthly usage allowance.

Gigabit Performance – bidders must commit to provide at least 1 Gigabit per second (Gbps) downstream and 500 Mbps upstream and offer an unlimited monthly usage allowance.

8 FNPRM, ¶¶ 2, 17.

9 *Id*., ¶ 17.

challenge in this proceeding is to translate those benefits into a weighting mechanism that will ensure CAF support is distributed efficiently.

One of the Commission's stated objectives for its four-tiered framework is to "provid[e] households in the relevant high-cost areas with access to high quality broadband services."[10] To achieve this goal, the Commission proposes to "establish weights for specific types of bids that represent the relative benefits of services that provides higher speeds, higher usage allowances, and/or lower latency over service that meets lower requirements for participation in the Phase II auction."[11] According to the FNPRM, the purpose of the proposed weighting system is to "provide rural consumers with the highest quality service while making efficient use of universal service funds."[12] As such, the Commission proposes to "adopt procedures for weights that would take into account the relative benefits to consumers of the various service tiers."[13] The FTTH Council agrees and submits that the bid weighting mechanism should be based primarily on consumer preferences and needs for broadband service throughout the duration of the program.[14]

There are various valid ways for the Commission to determine consumer preferences and needs. The FTTH Council regularly conducts and publishes surveys of consumer subscription to and use of various network technologies, broadband services, and applications/content. Most recently, it contracted with RVA LLC, a market research firm, to conduct a survey of consumers'

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10 *Id*., ¶ 207.

11 *Id*., ¶ 211.

12 *Id*., ¶ 212.

13 *Id*., ¶ 210.

14 Indeed, the Commission has already indicated that the "value to rural consumers of having access to different service levels" will be incorporated into the weighting system. FNPRM, ¶ 212.

broadband usage. The consumers surveyed reside in rural, suburban, urban and dense urban areas. The survey responses indicated the following:

- **Consumers residing in rural areas want access to the same caliber of broadband services that is available in urban areas.** The survey found that rural consumers typically spend nearly as much time online on a daily basis as consumers residing in suburban, urban and dense urban areas. Moreover, the majority of consumers surveyed in rural areas indicated that broadband service is "very important" to their communities.[15]

- **Consumer preference for high-performance broadband services is increasing and will continue to increase due to two primary factors: (1) increasing demand for online video applications; and (2) an increasing number of devices being used simultaneously.** Of the consumers surveyed, 83.3 percent indicated that they typically have between two and four devices running online video applications at the same time. These applications include streaming online video[16] and two-way video chat applications such as Facetime and Skype.[17]

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15 *See id.*, ¶ 208 (acknowledging "the benefits to achieving [the Commission's] other universal service objectives if a Phase II service provider will be able to provide broadband adequate to meet the needs of the entire community, including schools, libraries, and rural health care providers."). The FTTH Council previously studied the economic benefits of broadband availability for communities and found that, of the communities studied, "communities with widely available gigabit broadband … enjoyed over $1 billion in additional GDP when gigabit broadband became widely available, relative to communities where gigabit broadband was not widely available." *See* "Early Evidence Suggests Gigabit Broadband Drives GDP," prepared by the Analysis Group for the FTTH Council (Sept. 2014). A link to the study may be found at http://www.ftthcouncil.org/p/bl/et/blogid=3&blogaid=305 (last visited July 18, 2016).

16 A recent report issued by Sandvine indicated that Netflix currently accounts for approximately 35.2 percent of downstream traffic in North America. *See* Dan Deeth, "Global Internet Phenomena Report 2015-2016," Sandvine (June 2016), https://www.sandvine.com/trends/global-internet-phenomena/ (subscription required). Sandvine also projected that by 2020, approximately 80 percent of fixed access network traffic and 63 percent of mobile access network traffic will be caused by real-time entertainment. *Id.*

17 These survey results are consistent with general consumer trends for increased bandwidth demand due to the prolific use of two-way video applications. Video resolution quality also is improving and will continue to improve in the next decade, which will further contribute to demand for higher bandwidth, lower latency services. *See* Ed Harstead and Randy Sharpe, "Bandwidth demand forecasting (for TR section 4.2.2)," Alcatel-Lucent (Sept. 2014), http://www.ieee802.org/3/ad_hoc/ngepon/public/sep14/harstead_ngepon_01a_0914.pdf

The FTTH Council used this survey evidence along with other public data to determine the type of broadband performance consumers will need over time. As can be seen in the chart below, the Minimum Performance tier is expected as early as next year to have insufficient capability to enable a consumer with one device to have a satisfactory experience accessing video content. The Baseline Performance service tier faces similar constraints, especially when consumers use multiple devices. The Above-Baseline tier fares much better, but it is projected to prove inadequate for multi-devices users within a decade. Only the Gigabit Performance tier will have the performance level that can support long-term uncompromised broadband service for most consumers.

USER MINIMUM BANDWIDTH NEEDED FOR UNCOMPROMISED NEED

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
1 user	5.6	6.3	7.1	8.3	9.6	11.18	12.61	14.65	16.77	20.95	24.67	28.39	32.11	34.15	38.8	43.37
2 users	11.2	12.6	14.2	16.6	19.2	22.36	25.22	29.3	33.54	41.9	49.34	56.78	64.22	68.3	77.6	86.74
3 users	16.8	18.9	21.3	24.9	28.8	33.54	37.83	43.95	50.31	62.85	74.01	85.17	96.33	102.45	116.4	130.11
4 users	22.4	25.2	28.4	33.2	38.4	44.72	50.44	58.6	67.08	83.8	98.68	113.56	128.44	136.6	155.2	173.48
5 users	28	31.5	35.5	41.5	48	55.9	63.05	73.25	83.85	104.75	123.35	141.95	160.55	170.75	194	216.85
6 users	33.6	37.8	42.6	49.8	57.6	67.08	75.66	87.9	100.62	125.7	148.02	170.34	192.66	204.9	232.8	260.22
7 users	39.2	44.1	49.7	58.1	67.2	78.26	88.27	102.55	117.39	146.65	172.69	198.73	224.77	239.05	271.6	303.59

Years Bandwith Fill Cover Uncompromised Need For A Given Number Of Users

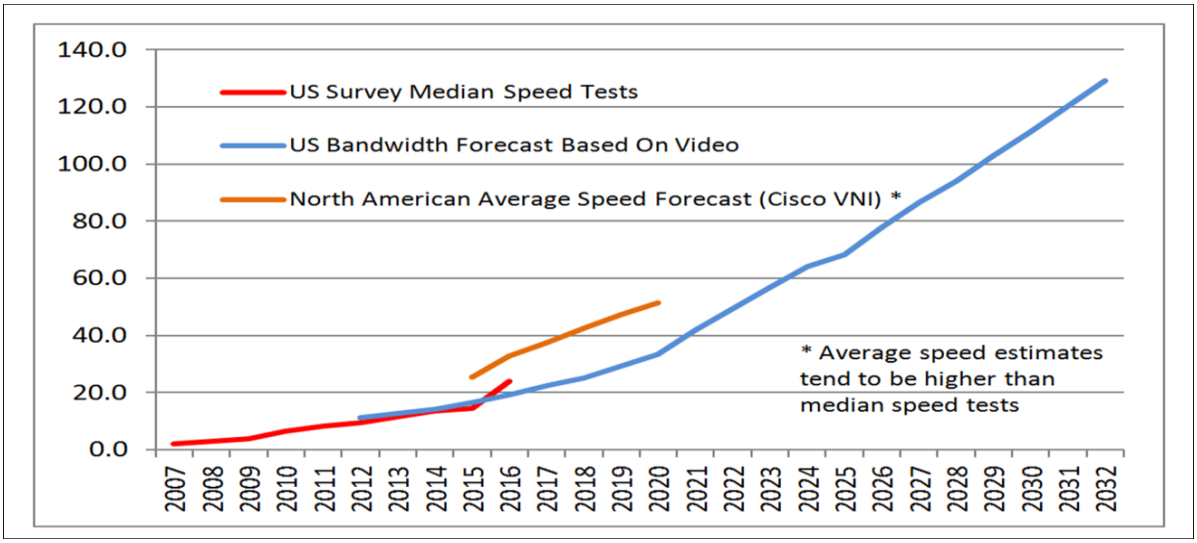
% Users	10/1	25/3	100/20	1000/500

The FTTH Council's survey and analysis of consumer need is consistent with other data and forecasts of minimum bandwidth usage per household (per device) as indicated by the chart below.[18] The Council submits that this consumer preference data on speed can be used to create a weighting factor to compare bids among the performance tiers. That is, greater weight should

(last viewed July 19, 2016) (projecting a near ubiquitous availability of high definition video (at least 720p60 HD) by 2024).

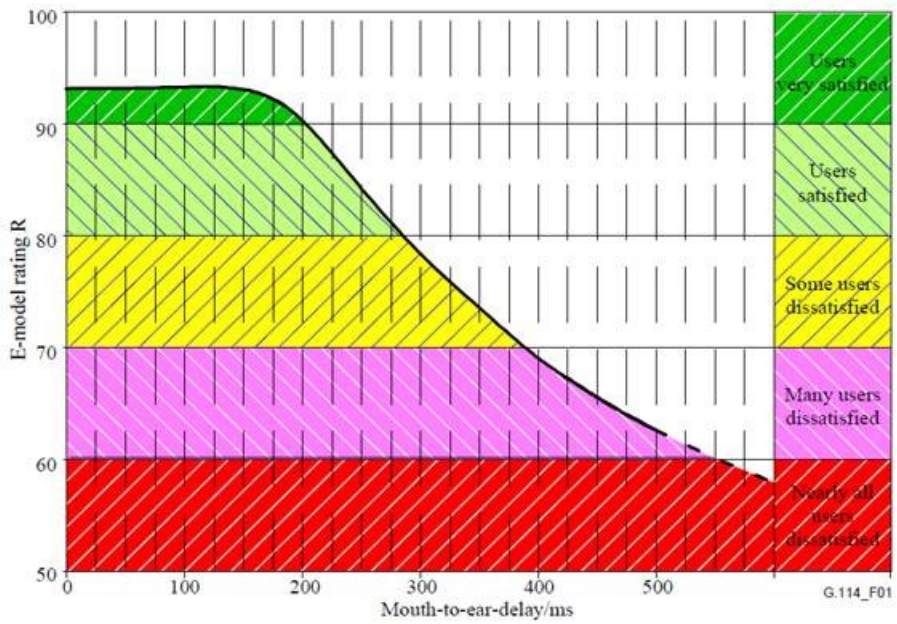
18 Survey Median Speed Test data was derived from surveys for the FTTH Council from RVA. The Bandwidth Forecast was developed by running a polynomial trendline on the speed test data. Cisco Virtual Networking data is available at http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html.

be given to bids from applicants seeking to deploy broadband service that is preferred by urban users and required by consumers to use applications and access content.



The Commission also can measure consumer preferences and needs for different latencies by surveying or otherwise reviewing and analyzing consumers' use of various latency-sensitive applications (*e.g.* two-way voice) and the technologies (broadband services) they use to access these applications. These data then can be used to develop an additional weighting factor.

As one example of the type of data that can be used to assess latency, the Council's Technology Committee prepared the appended paper on satellite broadband service and latency. Among the data in the paper is a chart prepared by a committee of International Telecommunications Union ("ITU") on user satisfaction at various latency levels:



The ITU committee recommends "that a one-way delay of 400 ms should not be exceeded for general network planning," but highly interactive tasks, such as many voice calls, require even lower latency. The Council submits this is the type of objective data the Commission could use to differentiate among bids seeking to deploy low and high latency broadband service.

In sum, consumer preference and need for different tiers of broadband service should form the primary basis of the Commission's weighting. This approach will help ensure that the needs of consumers in eligible areas are met. It also is consistent with the mandate of section 254 that consumers residing in rural areas should "have access to telecommunications and information services … that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services

in urban areas."[19] Deployment of services to support increased broadband demand will be key to ensuring that "rural America is not left behind."

Respectfully Submitted,

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[19] 47 U.S.C. § 254(b)(3).

TECHNOLOGY ASSESSMENT OF THE PERFORMANCE CAPABILITIES OF
SATELLITE PROVIDED BROADBAND INTERNET ACCESS SERVICE
Fiber to the Home Council Technology Committee
July, 2016

Introduction

Satellite-based technology can provide broadband Internet access service with unique performance capabilities. In this paper, the Fiber the Home Council's Technology Committee assesses those capabilities in comparison to other technologies and in reference to the public interest requirements adopted by the Federal Communications Commission (FCC) in the Connect America Fund (CAF) program.

Definitions

Bandwidth or speed – "Bandwidth" and speed are interchangeably used as the amount of data that can be transmitted in a given period of time, either downstream towards the end user, or upstream to the network from the end user. Higher amounts of bandwidth enable more traffic over the network, especially higher definition video, and more devices to and from a home.

Latency – "Latency" describes the elapsed time for data to travel through the network to and from the end user. Low latency is extremely important for delivery of real-time applications, such as audio and video communications-based applications.

Speed and Latency

Early rollouts of broadband service in the US and around the globe focused primarily on speed. Speed was most important for delivering early, one-way static webpage content, although latency also played a role. Speed also is important for delivering one-way video, as is latency. But, latency is becoming an even greater consideration as applications such as Skype, FaceTime and other communications services, telemedicine and distance learning, require two-way voice and video communication. Two-way communications place new demands on the network, and latency is a critical measure of how well these services can be delivered for users to have a satisfactory experience.

Internet access networks have developed rapidly over the past decade to meet user demands for two-way communications and streaming video over multiple devices. As a result, most users would consider 10/1 Mbps broadband type service to be minimal at best and would instead seek access to much higher speed service. Most new networks built today offer symmetric speeds of 1 Gbps and higher.

The table below, referencing the Performance Tiers proposed recently by the FCC for CAF Phase II support (FCC 16-64), highlights the difference in utility between different service levels. The lower tiers struggle to keep up with the requirements of even non-power users today.

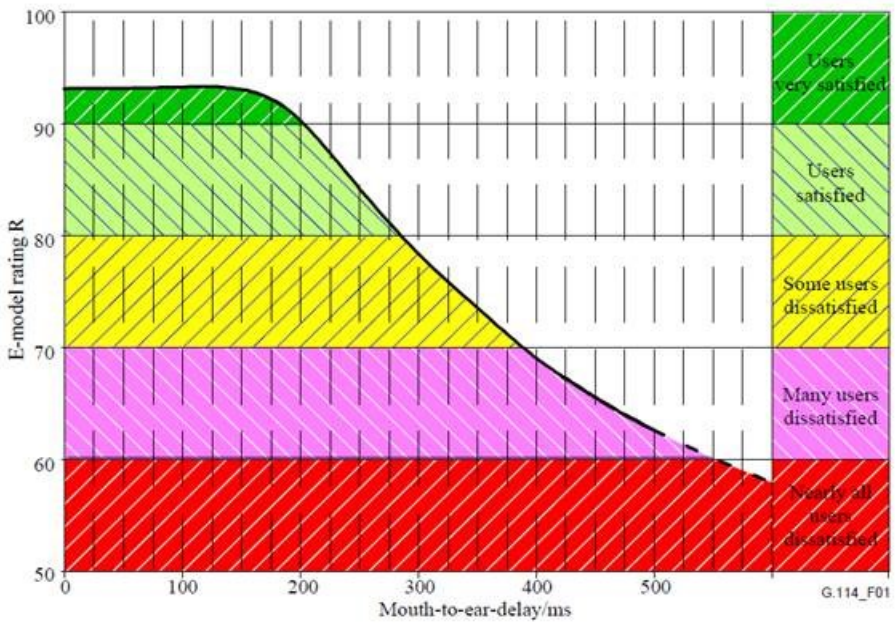
Performance Tier	Speed	Typical speed-sensitive home applications			
		Voice only	SD Video (4 streams downstream, 1 up)	HD Video (4 streams downstream, 1 up)	4K Video (4 streams downstream, 1 up)
Minimum	10/1	✓	✓ **minimal**	X	X
Baseline	25/3	✓	✓	X	X
Above Baseline	100/20	✓	✓	✓	X
Gigabit	1000/500	✓	✓	✓	✓

The differences in latency are even starker. Latency is typically not a large concern for typical terrestrial (principally wireline) networks, but as shown below, the "High Latency" performance tier is unusable for real-time communications.

Performance Tier	Latency (ms)	Typical latency-sensitive home applications		
		Real-time audio communications	Real-time video communications	Real-time gaming
Low Latency	≤100	✓	✓	✓
High Latency	≤750	X	X	X

The FCC has already acknowledged the importance of latency in networks. According to the 2015 FCC Report, "Measuring Broadband America," average satellite latency is between 600 and 700 milliseconds, or roughly 30x the latency of fiber optic systems. The report explains, "Latency may directly affect the perceived quality of highly interactive applications such as phone calls over the Internet, video chat, or online multiplayer games. The higher latencies of satellite-based broadband services may negatively affect the perceived quality of such highly interactive applications."

The FCC Report is consistent with latency benchmarks established by the International Telecommunication Union (ITU). The chart and summary below are taken from ITU G.114. Round-trip latency of 750 milliseconds corresponds to an "E-model rating R-value" of 65 ("many users dissatisfied"). R-value is the signal-to-noise ratio minus various impediments (*see* ITU G. 109 and G. 107). The ITU does not recommend any deployments below 50.



Summary

This Recommendation provides guidance on the effect of end-to-end one-way delay (sometimes termed latency), and an upper bound one-way network delay.

While it is recommended that a one-way delay of 400 ms should not be exceeded for general network planning, it is important to appreciate that highly interactive tasks (e.g., many voice calls, interactive data applications, video conferencing) can be affected by much lower delays.

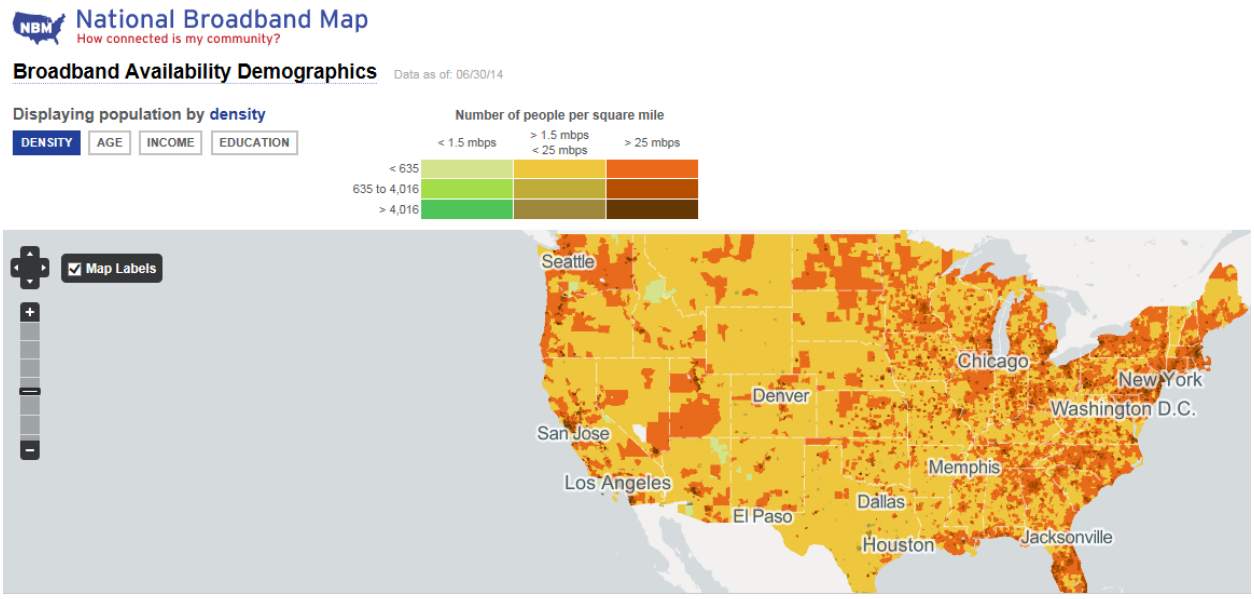
The effects of delays below 500 ms on conversational speech are estimated using a curve derived from the E-model (ITU-T Rec. G.107).

This version constitutes a major revision of this Recommendation in order to align with other ITU-T Recommendations of the G.100 series.

Satellite performance and use of applications

As a benchmark, users in rural areas should have “reasonably comparable” internet access as urban users. For instance, users are increasingly seeking access to medical care and education via applications and often require high performance – low latency – communications networks for two-way telemedicine and distance learning applications.

A review at the National Broadband Map (http://www.broadbandmap.gov/demographics) below quickly highlights the needs for higher performance service in rural areas.



As discussed above, satellite networks, because of their high latency and inability to scale, cannot adequately support today's real-time interactive applications.[1] Given the rate of technological change and increasing need for higher performance internet access service, rural residents using satellite broadband will fall even farther behind the technological curve.

Latency Benchmarks for Broadband Service

To ensure short and long-term network viability and meet consumer needs, most broadband providers set minimum latency standards along with speed standards. The existing Low Latency performance tier of <100 milliseconds is an excellent goal. ITU Recommendation G.114 provides an additional reference. It defines latency >400 milliseconds of one-way as unacceptable for general network planning purposes. This is a very generous limit, when typical recommendations from voice-over-IP services such as Skype recommend latency <200 milliseconds.

These standards are readily met today with wireline networks. Fiber to the home networks in particular offer the added benefit of scalability to support higher speeds for decades to come.

In sum, satellite networks do many things well, including providing GPS, monitoring weather, and transmitting one-way video. However, the distance between the earth and geostationary satellites is not going to decease, and we have not found a solution to compensate for latency due to the distance transmissions must traverse. (As for low-earth orbit constellations offering broadband service, these are proposals and so in-service operating characteristics are not known.)

[1] Satellite broadband makes use of WAN acceleration applications such as TCP proxies that mitigate much of the effect of latency for non-real time applications such as web access and even streaming video. But, these applications do nothing to help truly interactive real-time applications like voice- and video-conferencing or gaming.

In addition, satellite networks have significant scalability concerns. Where terrestrial networks are easily scalable by adding new optical or electrical circuits, satellite networks are not easily scalable to provide additional bandwidth as demands increase. This lack of scalable capacity could lead to usage caps at relatively low levels. As a result, satellite systems have limited value for most users who today demand and will increasingly need access to gigabit, symmetrical broadband service. That said, for users in more remote areas who have no alternatives, satellite broadband service may be the only cost-effective option.